N. A. C. A. BULLETIN

Vol. XII, No. 1 September 1, 1930

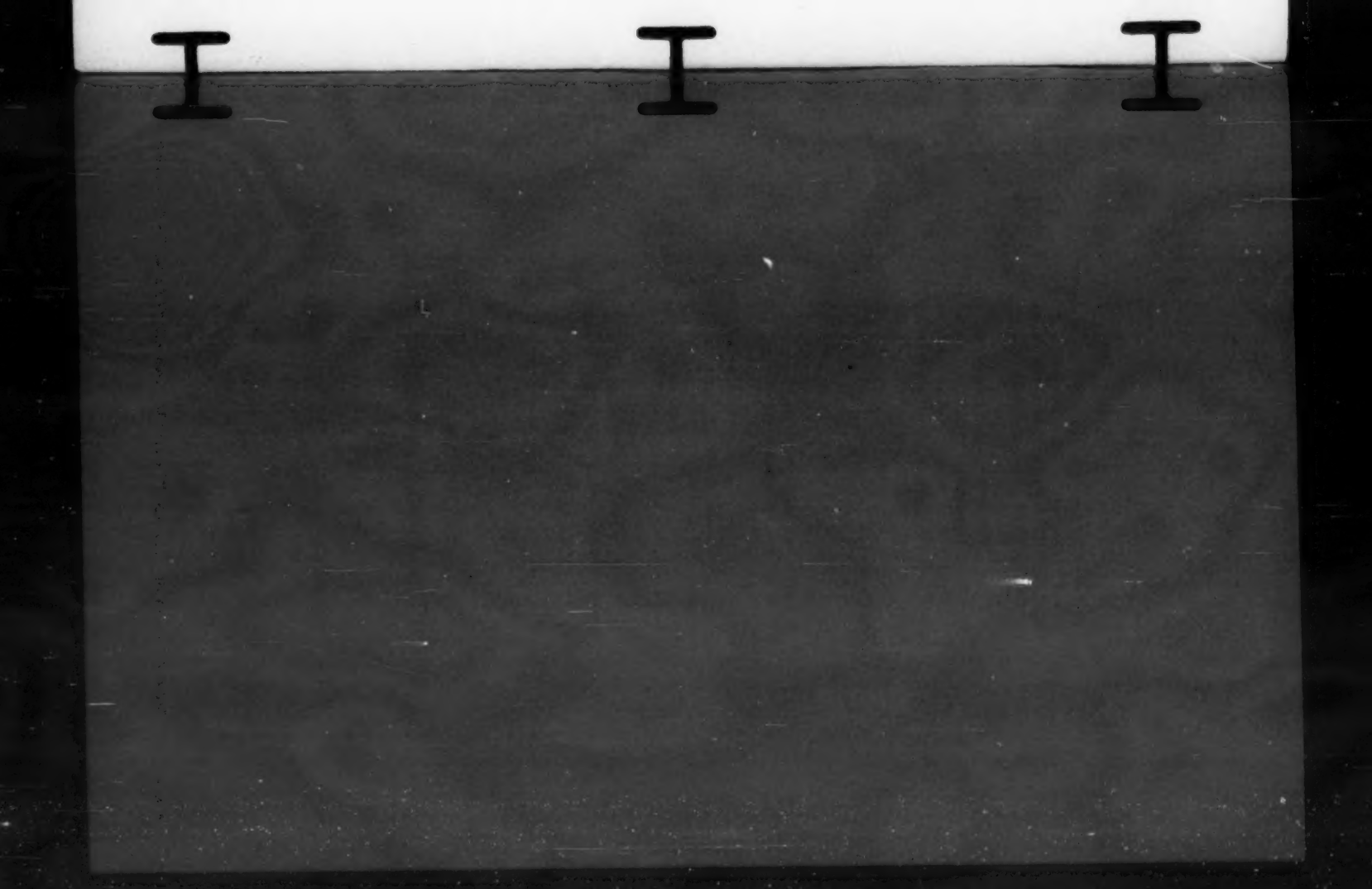
IN THREE SECTIONS

Section 1

N.A.C.A. LIBRARY

Some Important Points in Burden Distribution

This bulletin is published semi-monthly by the National Association of Cost Accountants, 1790 Broadway, New York, Subscription price $15.00 per year. Entered at the Post Office, New York, N. Y., as second class matter August 28, 1925, under the Act of March 3, 1879.



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Some Important Points in Burden Distribution

By

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The National Association of Cost Accountants does not stand sponsor for views expressed by the writers of articles issued as Publications. The object of the Official Publications of the Association is to place before the members ideas which it is hoped may prove interesting and suggestive. The articles will cover a wide range of subjects and present many different viewpoints. It is not intended that they shall reflect the particular ideas of any individual or group. Constructive comments on any of the Publications will be welcome.

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EDITORIAL DEPARTMENT NOTE

Largely because of the increasing mechanization of industry, overhead costs are assuming a more and more important place in proper cost accounting. Improper methods of overhead distribution now result in more inaccurate costs than was once the case.

As an Association, we are always interested in the exposition of actual methods which will lead to sounder cost figures, for in well organized industries these figures are being used as guides in policy to an ever-increasing extent.

Our paper this time describes a method that is adopted by one well organized industry. Its principles are, however, adaptable in many other industries.

Mr. Albert E. Grover, the author of this paper, has had a long experience in industrial accounting, a large part of which has been as a specialist in cost installations. Following ten years of service on the staff of one of Cleveland's most progressive accounting firms, he was the head of his own firm for a period of six years. He is at present connected with the National Machine Tool Builders Association as their Cost Consultant and during the past two years has been spreading the gospel of sound cost accounting throughout that Association in regional meetings and in individual work in the various plants in that industry.

Mr. Grover has served the Association as President of the Cleveland Chapter and was very active in the organization of the Rockford Chapter. He was elected a member of the National Board of Directors at the recent convention in Syracuse.

This paper was delivered before the Rockford Chapter.

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SEPTEMBER 1, 1930

SOME IMPORTANT POINTS IN BURDEN DISTRIBUTION

THE first consideration of every manufacturer is *PROFIT*, and the source of that profit—

The following outline shows a simple method of arriving at an "Operating Profit Aim."

Invested Capital—(current values):			
Land	$ 10,000.00		
Buildings	150,000.00		
Equipment	297,459.00		
Stores	200,000.00		
Accounts Receivable	80,000.00	$737,459.00	
Desire Income—20%		12,290.98	
less—6% Interest Charged to Cost		3,287.29	
OPERATING PROFIT AIM			9,003.69
Actual Operating Profit			5,864.10
UNATTAINED MARGIN			$3,139.59

You will note that this manufacturer thinks his income should be 20% of his investment in fixed and current assets. You will note also that his actual operating profit does not meet his aim.

There are three principle reasons most likely to cause "Unattained Margin." *First*—Being forced to sell his product in a market established by competition that does not sense good cost accounting as a stabilizer of market prices. *Second*—Inefficient operations. *Third*—Being in competition with one who has a lower profit ideal.

To determine the total profit and the source of that profit, it is first necessary to arrange the accounting system so that the Profit & Loss Statement will show classes of profit, then segregate the profit accruing from manufacturing and marketing into classes of product, further segregating to individual units where the circumstances warrant.

STATEMENT OF PROFIT AND LOSS

XYZ COMPANY .....Month of.....1928

Purchases:			
Production Materials.....$	675.00		
Buildings—(Depreciation) .	111.06		
Equipment—(Depreciation).	692.47	$ 1,478.53	
Sale of Scrap and By-products		376.00	
Sale of Outside Investments..		0	
Interest on Outside Investments		200.00	
Miscellaneous Income.....	450.00		
less Expense	310.00	140.00	
Interest on Investment taken in cost		3,287.29	
		5,481.82	
Deduct: Excess Capacity...		1,875.00	
NON OPERATING PROFIT			$3,606.82
Manufacturing and Marketing:			
Sales—Gross	58,532.60		
less Deductions	408.10	58,124.50	
Cost—Manufacturing	47,650.24		
Marketing	4,610.16	52,260.40	
OPERATING PROFIT			5,864.10
NET PROFIT			$9,470.92

Bear in mind that today's market on materials, labor and *burden* must be used in figuring costs of current sales, if you do your part in establishing a profitable sales policy in industry.

You purchase a quantity of material at a price below that prevailing when the material is used in production. If you use this advantage as a "club" to get business, you not only establish a precedent that tends to demoralize industry but your own chances

for repeat orders are placed in jeopardy when this lot of material is exhausted. Would it not be better to charge your costs with the market price prevailing when you use the material in manufacturing, and charge the difference between that amount and the actual cost to "Purchasing Profit"? Provision is made to segregate this class of profit on the above statement.

The next two items on the Profit and Loss Statement, "Building" and "Equipment" are the differences between depreciation taken into costs on reproduction value and depreciation computed on cost of acquisition. By setting up this amount as a profit you are able to charge depreciation on replacement values to production operations through your regular accounts, and, at the same time, satisfy the rulings of the internal revenue bureau. In effect you are reporting depreciation on cost values. You are also displaying to your officers, monthly, the advantages in profit due to having purchased buildings and equipment below the market of to-day.

Here again, is it not better to charge your costs with the present value of the utility you are consuming for the customer's benefit, and show the difference between that amount and the acquisition cost as a purchasing profit—which it really is?

Sale of scrap and by-products, sale of outside investments, and interest on outside investments are self-explanatory.

The cost of maintaining excess capacity is not a proper charge to operating expense; its inclusion in the burden application will increase the cost figures. But your competitors who do not have expense of excess capacity, naturally have no such item to reckon with. Showing this segregation on the monthly statement, of loss due to excess capacity, often spurs the organization on to more effectual sales activities.

Again you bump up against the rulings of the internal revenue bureau which, justly, considers interest on investment as an income. By accumulating the monthly charge to costs, and showing it as an item in your statement, in effect, you are aggregating interest income on which you pay taxes, even though charged to cost.

Good business practice contemplates the establishment of selling prices requiring the customer to pay a sufficient price for your product that will cover the cost of material, labor, and burden

plus an investment income and real profit from operations. In order that the variations in investments in the different production centers may earn their proper share of this investment income, operations through which the product flows must bear their proportionate share of the interest on investment used in the operation.

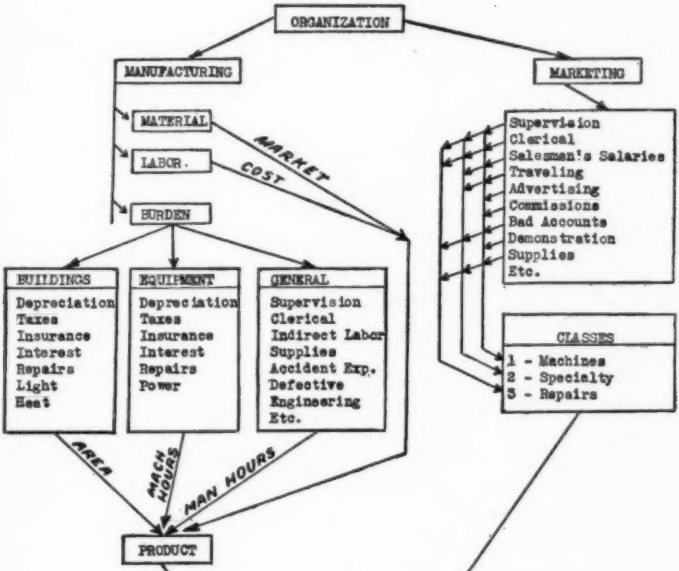
Most companies were organized to manufacture and market a product, and every item of cost is chargeable to one or the other of these activities. The following chart (Figure 1) shows the class of expenditures and accruals that are caused by manufacturing, likewise those caused by marketing activities.

You will note that manufacturing costs are divided into material, labor, and burden. As mentioned before, material is charged to cost at prevailing market when the material is used in production. Direct labor is charged at cost, and needs no further comment here.

Burden is charged to manufacturing cost on the basis of *normal* operating hours of production centers through which the individual parts and assemblies flow. Only plants manufacturing one article, and one size of that article, can secure accurate costs of finished product by distributing manufacturing burden on the basis of the direct labor or direct labor hours represented in each article. However, that result would be an *unsound* basis on which to establish a selling price if the cost of any excess capacity is included in the burden rate calculations. Most manufacturers make more than one size and type of product. Those who can secure accurate costs by the blanket-labor or direct-labor-hour methods of burden distribution are few indeed.

The plant is first divided into departments, including in each department only such area and equipment as are required to perform one class of work. Those departments that vary in burden cost to perform the separate operations are further divided into production centers and in many cases one individual producing unit is considered as a production center.

The burden cost of each department and production center is divided into three classes, representing the bases of distribution necessary to state correctly the cost of operations on the product.



PROFIT & LOSS

CLASS	SALES	COST			PROFIT LOSS
		Manufactur'g	Marketing	Total	
A	$ 42,730	$ 41,600	$ 2,800	$ 44,400	Loss- $1,670
B	170,230	135,460	11,780	147,240	22,990
C	10,100	9,600	1,100	10,700	Loss- 600
D	20,600	16,000	1,320	17,320	3,280
Total	$243,660	$202,600	$17,000	$219,660	$24,000

FIG. 1

These classes are—

(1) Buildings—A place for the man to work;
(2) Equipment—Tools for the man to work with;
(3) General—Supervision and clerical effort necessary to plan and record their activities; also supplies and other expenses in maintaining workable conditions in the departments.

Building expense consists of—

Depreciation on buildings.
Taxes on buildings.
Insurance on buildings.
Interest on investment in buildings.
Repairs to buildings.
Lighting.
Heating.

The total cost of this expense of furnishing a place for the men to work is distributed to production centers on the basis of area occupied by each.

Equipment expense consists of—

Depreciation on machinery and tools.
Taxes on machinery and tools.
Insurance on machinery and tools.
Interest on investment in machinery and tools.
Repairs to machinery and tools.
Power.

Depreciation, taxes, insurance, and interest-on-investment are allocated to production centers on the basis of the reproduction values of machinery and tools. Repair costs, both material and labor, are charged directly to production centers. Power cost is taken up among the production centers either through the use of individual meters for each center or by calculations based on the normal H.P. required to operate the equipment in the center multiplied by the hours operated.

General expense consists of—

Supervision.
Clerical.
Indirect Labor.
Supplies.
Accident Expense.

Defective Work.

Engineering.

Supervision is the cost of effort in planning and supervising the activities of men engaged in manufacturing. Supplies are those items of material that are used in production centers, and are not an integral part of the product being made. Indirect labor is the cost of all effort not used directly in producing. This item of burden does not include supervision or office salaries. Clerical is the cost of clerical effort in making out production orders, time keeping, pay roll, inventory records, costs and the portion of the general bookkeeping in connection with manufacturing and accounts payable records.

All general manufacturing expenses art distributed direct to production centers, on the basis of direct-labor hours used in the center.

The sum of building, equipment, and general burden application to each production center, divided by the normal operating hours of the center, will result in a rate of burden that is practical to use in cost and estimate calculations. Methods that do not comprehend the basis of distribution shown herewith are not only faulty, but are dangerous to the effective use of costs in establishing sales policies. Let me repeat the slogan of the cost department of our Association, *"effort spent on incorrect costs is a complete loss."*

If you distribute the total building, equipment and general classes of burden to departments on the basis of total production hours, the result would be a uniform rate for all departments. For example:

BURDEN ON PRODUCTION HOURS

	Foundry	*Machine Shop*	*Assembly*
Hours	4500	5000	2800
Expense	6210	6900	3865
Rate	1.38	1.38	1.38

By this method the foundry and assembly departments would be loaded with the cost of operating the expensive equipment in the machine shop and the results would be to increase the apparent cost of castings and decrease the apparent cost of machining.

Many manufacturers, and sometimes professional accountants,

claim that as long as the company markets only assembled machines, this method produces the same cost as the production center-distribution method. This conclusion would be true only if all parts of different machines made require uniform operations; and those operations, where too much burden is applied, are offset by other operations where the burden is understated. As stated before, this might apply satisfactorily where the manufacturer makes only one kind of machine and one size of that kind. But where more than one size of machine is made, some of the operations on one size will take more expensive equipment than the same operations on another size, and if correct costs of each size of machine are to be had, the higher cost of operating the more expensive equipment must be applied to the product requiring such equipment.

Effect of Faulty Burden Distribution

Production Center Method.

Let us take a concrete example of the effect on the burden rate by the use of the production center method compared with the blanket man-hour method.

I have selected for this example a planer and lathe (Figure 2):

Assume that it requires one man to run each of these machines and that the normal operating time for each is 130 hours per month. You will note the wide difference in area and machine values between the two machines. The man running the planer requires almost six times as much area in which to perform his operation as the man running the lathe; therefore, the operation should be charged with almost six times the building expense. Although the planer may not depreciate any faster than the lathe, yet measured in dollars to replace, the planer operations must bear about 9 times as much depreciation as the lathe; also about 9 times as much taxes and insurance are paid for the planer.

When the stockholders of any manufacturing company invested their money in equipment, they expected that equipment to produce a profit commensurate with the investment. They could have invested their money elsewhere and received a return of perhaps 6% without assuming the hazards surrounding manufacturing and marketing activities. Thus, in order to insure this 6% return on investment the planer operations must earn about 9 times as much

PLANER		LATHE
476' $14198		84' $1568
BURDEN	**PLANER**	**LATHE**
BUILDING	$28	$ 5
EQUIPMENT	278	31
GENERAL	75	75
TOTAL	$381	$111
NORMAL HOURS	130	130
RATE (MACHINE HOURS	2.93	.83
RATE (MAN HOURS	1.51	1.51

FIG. 2

interest as the lathe. Herein lies the real value of including interest on investment as a cost element.

It costs more to repair the planer than the lathe. Therefore this item of expense cannot be averaged over both and secure a correct cost of operations. The planer consumes more power than the lathe, and should be charged accordingly. General expenses can be divided practically between the two machines on the basis of operating hours.

By applying the various burden costs to the machines causing them, the rates are $2.93 per hour for the planer and $.85 per hour for the lathe.

By dividing the total shop burden by the total production hours of all operations on the product, we get a rate of $1.51 per hour which is incorrect in both cases.

How could we expect to get costs of the individual parts made by using $1.51 an hour burden charge on all operations, when there is such a variation in cost of operating the different pieces of equipment in the plant as is here demonstrated with the planer and lathe. *Bear this in mind, as the finished product is the assembly of individual parts, so the cost of the finished product is the assembly of costs of the individual parts, and errors in costs of the parts must reflect errors in cost of the finished product.*

Direct Labor Method.

Distribution of burden on the basis of direct labor has all the irregularities of the blanket production-hour method just explained, with the variation of wages paid to machine operators added. There is absolutely no relation between operators' com-

Burden	*Mill No. 13*	*Mill No. 14*
Building	5	5
Equipment	70	70
General	75	75
Total	150	150
Labor	100	150
Cost { Machine Hours	250	300
Cost { Labor	220	330

pensation and the cost of running the machine. Of all the inaccurate methods of burden distribution this method is the most unreliable.

Assume that you have two mills, exact duplicates. On one of these mills you perform an operation that requires more skill and experience than the operation on the other mill; naturally you pay more for the direct labor on the job. Does it cost any more to furnish a place to work for one man than the other? Does it cost any more to run one machine than the other? Does one man require more supervision? Probably the experienced workman, who is paid more per hour, requires less supervision, yet with the direct labor method of burden distribution we charge more burden to the jobs done by the higher priced workman, and less burden to the lower priced workman.

In this example the labor cost on the operation performed on machine No. 13 is $100.00 and the labor cost of the operation on No. 14 is $150.00. The machines being duplicates and the operations having the same elapsed time, the burden is the same.

The true costs of the jobs are—

On Mill No. 13	= Direct labor.....	$100.00
	= Burden	150.00
	= Total	$250.00
On Mill No. 14	= Direct labor.....	$150.00
	= Burden	150.00
	= Total	$300.00

If you distribute the $300.00 burden cost to the jobs on the basis of direct labor, the result would be:

On Mill No. 13	= Direct labor.....	$100.00
	= Burden	120.00
	= Total	$220.00

On Mill No. 14	= Direct labor.....	$150.00
	= Burden	180.00
	= Total	$330.00

This condition is not overdrawn, as it happens often in any plant whether labor is paid according to straight day work or piece work.

Example of Faulty Distribution.

In order that I may demonstrate more clearly the effect of faulty distribution, I have figured the cost of machining a base weighing 457 lbs.

Casting 457 lbs. at .050.....	$22.50
Labor, 4 hours	3.20
Prime Cost	$26.05

	Burden Hours	Burden Mach. Hrs.	Prod. Hrs.	Labor
Plane	1.9	$5.55		
Bore	1.0	1.89		
Mill	.5	.48		
Drill	.6	.40		
Total	4.0	$8.32	$6.40	$5.44
Total Cost		$34.37	$32.45	$31.49
Error		0.	$1.92	$2.88
% of Error		0.	5.6	8.4

The cost of the casting from the cleaning room was 22.85. It required four hours to machine the casting. The direct labor cost was $3.20. The prime cost (material and labor) amounted to $26.05. This cost would be the same under any system of burden application.

This casting required the use of four separate kinds and capacities of machines to put it in shape for assembly. Each of these

machines cost different amounts per hour to operate. Therefore, to reflect a true cost of the machined casting I have multiplied the hours the machines were used by the burden rates per hour. The results of this calculation are shown in the column headed "Machine Hours." The total burden cost of the casting was $8.32. If I had used the production hour method the burden cost would have shown $6.40. If I had used the direct labor method the burden cost would have shown $5.44.

Adding the burden cost, shown by each of the three methods, to the prime cost, the total cost would be—

Machine hour method.....	$34.37
Production hour method.....	32.45
Direct labor method.....	31.49

The production hour method is 1.92 or 5.6% in error, and the direct labor method is $2.88 or 8.4% in error; a pretty unhealthy loss to assume to save a small cost of clerical effort.

Manufacturers in general will agree that the principle of production center burden application is sound, yet a majority of these same manufacturers will offer one or the other or both of two excuses for not practicing the method in their own plants; "my business is different,", or "it costs too much clerical effort."

Your business may be different than other manufacturers, yet you have departments and production centers where you use equipment that varies in floor space occupied, capital investment, repairs, and power. So, in this respect, you are like all manufacturers, and the principles of burden application that are sound for industry are sound for you.

The second excuse, concerning the extra cost of clerical effort required to distribute burden correctly, has no merit. You spend large sums in engineering and sales promotion to place a product on the market, yet you say it costs too much to know exactly whether the income from its sale is sufficient to cover the cost of material, labor, and burden (distributed correctly) leaving a balance sufficient to replace the worn-out buildings and equipment caused by manufacturing this machine, and a satisfactory dividend for your stockholders.

"Results, not excuses." I have seen this motto conspicuously exhibited in the offices of manufacturers. I dare say there are

some in this room whose office walls are adorned with this splendid motto. Right here let me say that the first consideration is "Results! then economy in securing them!"

In 16 years of industrial cost system installations, I have had the opportunity of supervising the establishment of production center burden applications in many plants. To my knowledge, not one of those manufacturers returned to the old inaccurate methods. Therefore it is reasonable to believe they found the results sufficient to warrant the small amount of extra clerical effort required.

Clerical Effort Required for Good Costing

For the benefit of any of my listeners who are not using production center burden application, I have prepared some figures showing the approximate cost of clerical effort in a machine tool plant operating with 127 men.

CLERICAL EFFORT

	Mach. Hrs.	Dept. Hrs.	Labor
Pay Roll	$1,590	$1,590	$1,590
Burden	275	15	8
Cost	1,370	1,150	1,040
Inventory	1,565	1,565	1,565
Total Cost	$4,800	$4,320	$4,203

This cost of clerical effort is based upon my personal experience in installing cost systems over a period of 16 years. It takes into account the cost of individual parts, preparation of cost of sales for profit and loss, a perpetual inventory and tieing up the cost accounting with the general books. You will note that there is a reduction in clerical effort of $600.00 per year by distributing burden on direct labor, if you pay your cost clerks $1.00 per hour.

Let me again repeat, "effort spent on incorrect costs is a complete loss." Why spend $4,200.00 a year to get costs that are useless for establishing sales policies or controlling the activities of your producing centers, when an additional $600.00 expenditure will insure you against loss, due to inaccurate costs.

There is absolutely no doubt that ignorance of the cost principles I have tried to explain to you, and the unwillingness of manufacturers to adopt them, are contributing factors in the unpleasant profit situation of industry.

Early in this paper we mentioned the segregation of manufacturing and marketing activities into classes of product so that we might know which class or classes of machines and other products are profitable. As manufacturing cost is one of the largest factors in determining profit, and burden is usually the largest factor of manufacturing cost, is it not essential that we should spare no effort in seeing that each class of product bears its correct share of the cost of operating the equipment used in its manufacture?

Going back to page —, please note the arrangement of the Profit and Loss Statement shown on the exhibit. Net sales by classes are easily accumulated. Costing the product shipped is not an expensive operation. The cost of marketing each class of product is not so much a matter of clerical effort as judgment and analysis.

Having eliminated the timeworn custom of accumulating certain of the manufacturing and marketing expenses into a third class known as "Administration Expenses", a profit or loss for each class of product is easily obtained. You will note that classes A and C each show a loss and classes B and D show profits. The wise executive will insist on immediate explanation why there was no profit earned on classes A and C.

There are isolated cases where it would be poor business judgment to discontinue making products which show a consistent loss, like that shown in class "A" of this exhibit. The plant might be especially equipped to make product "B" but very costly in the production of product "A." By furnishing the customer with a small quantity of product "A," the concern may be in a position to secure orders for large quantities of product "B", which is profitable. There is nothing demoralizing to industry in this transaction, as the manufacturer has not cut the price, but rather accepted his loss accruing from manufacturing a product in a plant not properly equipped to manufacture economically the product in class "A".

Ordinarily a showing like class "A" would call for very careful analysis to reach a decision whether to continue to manufacture or take the product from the market. The soundness of the manu-

facturer's decision depends on the soundness of his cost procedures.

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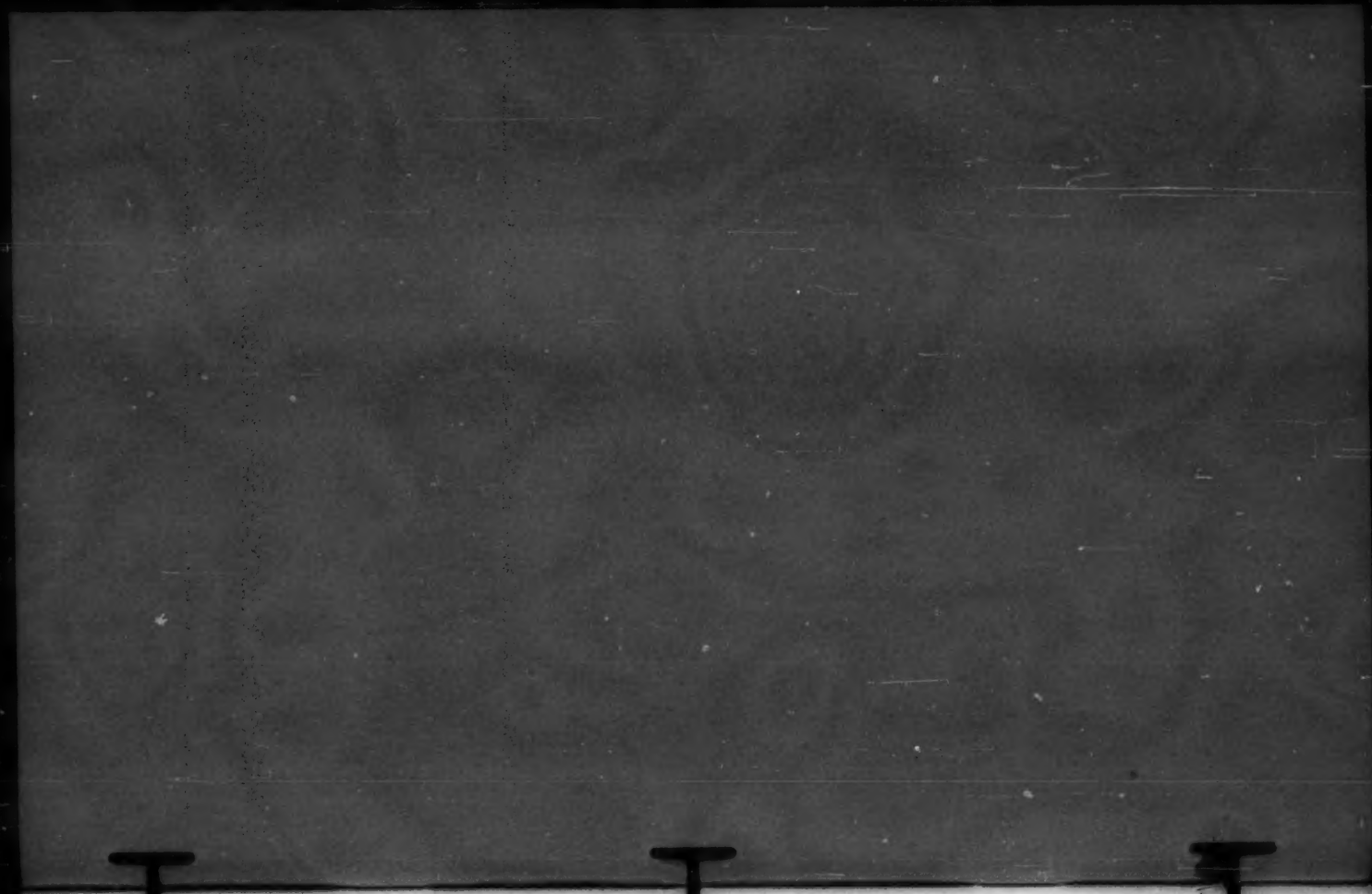

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